

BRIEF REPORT

Investigating cigarette affordability in 60 cities using the cigarette price-daily income ratio

Ming-yue Kan

Tobacco Control 2007;16:429-432. doi: 10.1136/tc.2007.020487

Objective: To investigate cigarette affordability in 60 cities.**Methods:** Affordability of cigarettes is defined as the ratio of the price of one pack of cigarettes to daily income (cigarette price-daily income ratio: CPDIR). Daily income data were calculated using the mean of the seven occupations with the lowest daily wage, as listed in the 2006 Union Bank of Switzerland survey; cigarette prices in 2006 were sourced from the Economist Intelligence Unit.**Results:** Cigarette affordability in most of the surveyed cities remains high. There is a tendency for cities with high income economies to have a high level of cigarette affordability. Most of the cities in Western Europe and South and North America have high cigarette affordability, whereas 66.7% of their counterparts in Eastern Europe have medium cigarette affordability. In Asia, all cities with high cigarette affordability belong to the group of upper middle to high income economies, except for the Philippines. In Africa, Johannesburg and Nairobi have high and medium levels of cigarette affordability, respectively.**Conclusion:** Cigarette affordability for most of the sampled cities, especially those in high income economies, is high. There is room for increasing cigarette prices via tax increases. There is a risk that the increase in cigarette prices in newly emerging economies lags behind the high speed of economic growth being experiencing. Tax increases should be given high priority.

Price increases have long been seen as an effective strategy for reducing cigarette consumption.¹⁻³ Previous research has demonstrated that price is an especially effective instrument in preventing youth smoking.⁴⁻⁷ Tobacco tax is widely used as the major tool to increase the price of tobacco products. Several researchers have focused on the affordability of tobacco products. This article reviews the previous literature on cigarette affordability and compares cigarette affordability in 60 cities using a modified calculation method.

AFFORDABILITY OF CIGARETTES

Lal and Scollo used the Big Mac index, published annually by the *Economist* as a purchasing power parity (PPP), to calculate the price of cigarettes in 30 countries.⁸ The advantage of this method is the ready availability of data. However, the use of the price of a single commodity as the PPP commonly produces misleading results. Table 1 presents the prices of selected commodities from five cities. If the price of fuel instead of a Big Mac is used as the PPP, purchasing power in Singapore and Hong Kong is significantly reduced. Moreover, since in Lal and Scollo's paper there is no consideration given to the level of income, their contribution is limited to the comparison of cigarette prices in different countries but not affordability. More expensive does not mean less affordable.

Guindon *et al* noticed the distortion effect of the Big Mac index. In addition to using the Big Mac index, they also used

the price of a 1 kg loaf of bread and rice as references.⁹ This approach minimised the flaws inherent in using the Big Mac index. Their most significant contribution was to use income (defined in minutes of labour) to calculate the affordability of cigarettes. The average wage of 12 occupations published by the Union Bank of Switzerland (UBS) was used to calculate cigarette affordability (minutes of labour required to purchase one pack of cigarettes) in 56 cities. Given that these 12 occupations in the UBS's survey cover different ranks, the application of the average wage does not address the fact that income disparity was ignored.

Blecher *et al* recognised that the UBS's survey on income was "a more direct way of estimating people's income"; however, they also highlighted the limitations of the UBS survey being only conducted every three years and being based on fewer samples than the survey undertaken by the *Economist*. Instead, they used commonly available data: gross domestic product (GDP) per capita. Affordability was therefore defined as "the percentage of per capita GDP required to buy 100 packs of cigarettes."¹⁰ Clearly, Blecher *et al* found an easier way to calculate cigarette affordability. Despite being aware of the issue of income distribution, they considered that GDP per capita was a good indicator of living standard and, therefore, no remedy was proposed.¹⁰

Previous research has demonstrated that different income groups respond differently to a price measure. The price measure for cigarettes is more effective in low income groups than those with high income.¹¹⁻¹³ Moreover, smoking is more prevalent in lower income groups.^{14, 15} Smoking exacerbates poverty.¹⁶ Low income groups rely heavily on public medical services. Expenditure on treating smoking related diseases in the public medical sector could be greatly diminished if the smoking rate was reduced in low income groups. In other words, when we assess the affordability of cigarettes, more attention should be given to lower income groups.

Table 1 Price of commodities in five cities (\$US)

	Big Mac*	Food†‡	Fuel†§	Restaurant†¶
Hong Kong, China	1.55	481	1.9	26
London, UK	3.14	473	0.82	64
New York, USA	3.1	555	0.83	50
Shanghai, China	1.31	274	0.57	31
Singapore	2.27	492	1.12	29

**Economist*; † Union Bank of Switzerland, 2006.

‡Cost of a weighted basket containing 39 foodstuffs.

§Price of gas per litre.

¶Price of an evening meal (three course menu with starter, main course and dessert, with drinks) including service, in a good restaurant.

Abbreviations: CPDIR, cigarette price-daily income ratio; EIU, Economist Intelligence Unit; FCTC, Framework Convention on Tobacco Control; GDP, gross domestic product; GNP, gross national product; PPP, purchasing power parity

Table 2 Cigarette affordability levels in 60 cities

City	Country	Location	Lowest cigarette price	Mean daily income	CPDIR	Cigarette affordability level	Rank
Taipei	Taiwan, China	Asia	0.92	35.42	0.03	High	1
Tokyo	Japan	Asia	2.46	67.87	0.04	High	2
Dubai	United Arab Emirates	Asia	1.77	44.15	0.04	High	3
Bratislava	Slovakia	E Europe	0.65	13.39	0.05	High	4
Zurich	Switzerland	W Europe	4.72	91.66	0.05	High	5
Luxembourg	Luxembourg	W Europe	3.35	60.39	0.06	High	6
Geneva	Switzerland	W Europe	4.55	76.75	0.06	High	7
Barcelona	Spain	W Europe	2.75	45.32	0.06	High	8
Madrid	Spain	W Europe	2.75	44.54	0.06	High	9
Miami	United States	N America	3.29	49.67	0.07	High	10
New York	United States	N America	5.25	74.44	0.07	High	11
Sao Paulo	Brazil	S America	1.11	15.58	0.07	High	12
Seoul	Korea, Rep.	Asia	2.44	33.97	0.07	High	13
Chicago	United States	N America	5.80	77.81	0.07	High	14
Moscow	Russia	E Europe	0.99	13.07	0.08	High	15
Los Angeles	United States	N America	5.38	70.37	0.08	High	16
Amsterdam	Netherlands	W Europe	4.13	50.49	0.08	High	17
Copenhagen	Denmark	W Europe	4.97	59.41	0.08	High	18
Athens	Greece	W Europe	2.81	33.46	0.08	High	19
Milan	Italy	W Europe	3.75	44.34	0.08	High	20
Manila	Philippines	Asia	0.47	5.48	0.09	High	21
Buenos Aires	Argentina	S America	1.03	11.78	0.09	High	22
Bogota	Colombia	S America	0.83	9.35	0.09	High	23
Brussels	Belgium	W Europe	4.70	52.80	0.09	High	24
Caracas	Venezuela, RB	S America	0.98	11.00	0.09	High	25
Helsinki	Finland	W Europe	5.00	54.91	0.09	High	26
Frankfurt	Germany	W Europe	5.26	57.73	0.09	High	27
Berlin	Germany	W Europe	5.00	54.76	0.09	High	28
Stockholm	Sweden	W Europe	5.41	57.06	0.09	High	29
Rio de Janeiro	Brazil	S America	1.11	11.51	0.10	High	30
Kuala Lumpur	Malaysia	Asia	1.46	14.99	0.10	High	31
Rome	Italy	W Europe	3.88	39.10	0.10	High	32
Johannesburg	S. Africa	Africa	2.31	22.74	0.10	High	33
Vienna	Austria	W Europe	4.99	48.10	0.10	High	34
Montreal	Canada	N America	5.85	55.46	0.11	Medium	35
Dublin	Ireland	W Europe	7.75	68.85	0.11	Medium	36
Sofia	Bulgaria	E Europe	0.77	6.54	0.12	Medium	37
Warsaw	Poland	E Europe	1.58	12.95	0.12	Medium	38
Sydney	Australia	Asia	6.62	54.17	0.12	Medium	39
Prague	Czech Republic	E Europe	2.35	19.22	0.12	Medium	40
Lisbon	Portugal	W Europe	3.00	23.64	0.13	Medium	41
Bangkok	Thailand	Asia	0.92	7.28	0.13	Medium	42
Auckland	New Zealand	Asia	6.51	50.96	0.13	Medium	43
Istanbul	Turkey	E Europe	2.24	17.22	0.13	Medium	44
Toronto	Canada	N America	7.14	54.60	0.13	Medium	45
Lima	Peru	S America	1.52	11.43	0.13	Medium	46
London	United Kingdom	W Europe	8.96	66.81	0.13	Medium	47
Oslo	Norway	W Europe	10.31	76.71	0.13	Medium	48
Paris	France	W Europe	5.63	40.98	0.14	Medium	49
Hong Kong	Hong Kong, China	Asia	4.12	29.00	0.14	Medium	50
Jakarta	Indonesia	Asia	0.86	5.95	0.14	Medium	51
Bucharest	Romania	E Europe	1.21	8.26	0.15	Medium	52
Nairobi	Kenya	Africa	1.07	7.28	0.15	Medium	53
Mumbai	India	Asia	1.10	6.85	0.16	Medium	54
Mexico City	Mexico	N America	1.54	9.63	0.16	Medium	55
Budapest	Hungary	E Europe	2.37	14.29	0.17	Medium	56
Singapore	Singapore	Asia	5.95	29.00	0.21	Low	57
Shanghai	China	Asia	1.56	6.54	0.24	Low	58
Beijing	China	Asia	1.73	6.85	0.25	Low	59
Kiev	Ukraine	E Europe	2.11	6.93	0.30	Low	60

CPDIR, cigarette price-daily income ratio.

Furthermore, in those countries with a high level of income disparity, the use of average income as an indicator may produce a biased result. For example, the gross national product (GNP) per capita for Hong Kong in 2005 was \$HK199 498¹⁷; however, the median monthly household income for 2005 was only \$HK16 000. Taking into account the average household size (3.1), the median annual individual income was only \$HK61 936.¹⁸ The difference between the two figures is more than 300%, revealing that the use of GNP per capita to calculate

cigarette affordability in Hong Kong results in an overestimation of the affordability level.

Sources and methods

In this paper, the affordability of cigarettes is defined as the ratio of the price of one pack of cigarettes to daily income (cigarette price-daily income ratio; CPDIR). A low CPDIR means high affordability, and vice versa. In assessing the income level, I used the mean of the lowest seven daily wage

Table 3 Cigarette affordability levels by income levels in 59 cities

Income classification*	Cigarette affordability level			Total
	High	Medium	Low	
	(CPDIR ≤ 0.10)	(CPDIR > 0.10 and ≤ 0.20)	(CPDIR > 0.20)	
High income	24 (68.6%)	10 (28.6%)	1 (2.9%)	35 (100%)
Upper middle income	5 (45.5%)	6 (54.5%)	0 (0.0%)	11 (100%)
Lower middle income	4 (36.4%)	4 (36.4%)	3 (27.3%)	11 (100%)
Low income	0 (0.0%)	2 (100.0%)	0 (0.0%)	2 (100%)
Total	33 (55.9%)	22 (37.3%)	4 (6.8%)	59† (100%)

CPDIR, cigarette price-daily income ratio.

*The cities are classified according to their income classification issued by the World Bank to their respective countries.

†The income level of Slovakia has not been classified by the World Bank; therefore, Bratislava is not included here.

Table 4 Cigarette affordability levels by geographical location in 60 cities

Location	Cigarette affordability level			Total
	High	Medium	Low	
	(CPDIR ≤ 0.10)	(CPDIR > 0.10 and ≤ 0.20)	(CPDIR > 0.20)	
Asia*	6 (40.0%)	6 (40.0%)	3 (20.0%)	15 (100%)
Africa	1 (50.0%)	1 (50.0%)	0 (0.0%)	2 (100%)
Western Europe	16 (76.2%)	5 (23.8%)	0 (0.0%)	21 (100%)
Eastern Europe	2 (22.2%)	6 (66.7%)	1 (11.1%)	9 (100%)
North America†	4 (57.1%)	3 (42.9%)	0 (0.0%)	7 (100%)
South America	5 (83.3%)	1 (16.7%)	0 (0.0%)	6 (100%)
Total	34 (56.7%)	22 (36.7%)	4 (6.7%)	60 (100%)

CPDIR, cigarette price-daily income ratio.

*Including Sydney and Auckland.

†Including Mexico City.

occupations of the 2006 UBS survey, which covered 14 occupations with a range of ranks.¹⁹ This approach minimises the distortion effect of income disparity. The household income of a particular percentile (for example, 20th or 30th percentile) may be more accurately reflected as the income of a low income group; however, periodic worldwide data are commonly unavailable. The World Development Indicator, published annually by the World Bank, seems to be the best available option; however, its usefulness is limited by the fact that the survey is undertaken in different years (from 1983 to 2003).²⁰

The world cost of living, as published by the Economist Intelligence Unit (EIU), periodically provides the prices of more than 160 items found in over 130 cities worldwide, including cigarette prices in supermarkets and mid-priced stores (Marlboro and local brands).²¹ This paper used the lowest priced cigarette in 2006 published in this survey to calculate the cigarette affordability.

The selection of cities is solely based on the availability of data. From the data sets of the EIU and UBS, only 60 cities appeared in both samples; all 60 are therefore included in this paper.

RESULTS

Table 2 shows cigarette affordability levels in 60 cities, representing the cigarette price as a percentage of the daily income (CPDIR). The affordability levels range from 0.03 (Taipei) to 0.30 (Kiev). The cigarette affordability level of 34 of the 60 cities (56.7%) is equivalent to or below 0.10, and only four cities (6.7%) returned values higher than 0.20. These results show that most cities still have high cigarette affordability levels. Table 3 lists the cigarette affordability levels for 59 cities in terms of their respective economies' income level

classified by the World Bank. There is a tendency for cities with higher income economies to also have higher cigarette affordability levels. The cigarette affordability for 68.6% ($n=24$) of high income cities was at a high level ($CPDIR \leq 0.10$), whereas only 2.9% ($n=1$) of high income cities had low levels of affordability (>0.20). In the upper middle income group, the percentage of cities with a high level of cigarette affordability declines to 45.5% ($n=5$), with none at the lower levels. Most of the sampled cities in this income group had mid-level cigarette affordability (54.5%, $n=6$). The cigarette affordability of cities with lower middle income was evenly spread: no single level of cigarette affordability represented 50% of the cities in this group. An interesting finding is that all low income cities have a mid-level cigarette affordability. The reason behind this may come from its small sample size (table 3).

Table 4 lists cigarette affordability in terms of geographical location. Most of the cities in Western Europe and South America have a high level of cigarette affordability, whereas 66.7% of their counterparts in Eastern Europe have a medium level. In North America, the relatively low cigarette price of the four sampled US cities changed the landscape for cigarette affordability in this area. The average cigarette prices for these

What this paper adds

Previous researches demonstrated that different income groups responded differently to price measure. Price measure of cigarette is far more effective in low income than high income groups.

four cities is only 75% of that in the sampled cities in Canada. In addition, the average daily income in the US cities is 1.2 times higher than that in the Canadian cities. In Asia, all cities with high cigarette affordability (40%) belong to upper middle to high income economies, with the exception of the Philippines. Three out of every four cities with low cigarette affordability are located in Asia. Given China's relatively low income levels, it is no surprise that Shanghai and Beijing are included. An interesting point is the low cigarette affordability of Singapore, the only high income economy with a high CPDIR. The African cities of Johannesburg and Nairobi have a high and medium cigarette affordability level, respectively. This difference in affordability between the two cities can be attributed to the wide income gap between them (over three times).

DISCUSSION

These results show that the cigarette affordability for most of the sampled cities, especially those with high income economies, is high. Article 6 of the World Health Organization's Framework Convention on Tobacco Control (FCTC) concerning price and tax measures does not clearly set a standard for cigarette and tax measures. Instead, it requests that signatories submit periodic reports of rates of tobacco taxation and tobacco consumption trends. This requirement motivates the signatories to take effective action. Reviewing cigarette affordability will surely become a core task of the tobacco control agencies of each signatory country. It is hoped that periodic monitoring and a reduction in cigarette affordability will reduce both the smoking population and cigarette consumption.

There is a risk that the rate of increase in cigarette prices within newly emerging economies is still much lower than their high rate of economic growth. When data from 2003 and 2005 are compared (data are available upon request), the CPDIR of 20 cities from a total of 57 (35.1%) had decreased, with 70% of these cities situated in Asia, Eastern Europe and South America. In Eastern Europe and South America, 57.1% and 83.3% of the compared cities in these areas recorded a decrease in their CPDIR, respectively. This study found that most cities within high income economies have a high cigarette affordability level. As the newly emerging economies approach high income levels, immediate measures should be taken to avoid a duplication of the experiences of their predecessors.

Competing interests: The author is affiliated with the Committee on Youth Smoking Prevention based in Hong Kong. The committee has received donations (total amount: \$HK32 655 317) from three tobacco companies and Tobacco Institute of Hong Kong from 2002 to 2007 on two preconditions: no interference and no acknowledgment.

This paper used the income of low income group to measure the cigarette affordability.

Correspondence to: Ming-yue Kan, Committee on Youth Smoking Prevention, 1202 Methodist House, 36 Hennessy Road, Wan Chai Hong Kong, Hong Kong; kan@ysp.org.hk

Received 29 January 2007

Accepted 1 July 2007

REFERENCES

- 1 Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000;**321**:358–61.
- 2 World Health Organization. *WHO framework convention on tobacco control*. Geneva: WHO, 2003.
- 3 The World Bank. *Curbing the epidemic: governments and the economics of tobacco control*. Washington DC: The World Bank, 1999.
- 4 Center for Substance Abuse Prevention of the US. Response to increases in cigarette price/ethnicity, income, and age groups—United States, 1976–1993. *Morb Mort Wkly Rep* 1998;**47**:605–9.
- 5 Crawford MA. Responses to tobacco control policies among youth. *Tob Control* 2002;**11**:14–9.
- 6 World Health Organization. *Guidelines for controlling and monitoring the tobacco epidemic*. Geneva: WHO, 1998.
- 7 California Department of Health Services. *2004 California tobacco control update*. Sacramento, CA: California Department of Health Services, 2004.
- 8 Lal A, Scollo M. Big Mac index of cigarette affordability. *Tob Control* 2002;**11**:280–2.
- 9 Guindon GE, Tobin S, Yach D. Trends and affordability of cigarette prices: ample room for tax increases and related health gains. *Tob Control* 2002;**11**:35–43.
- 10 Blecher EH, Walbeek CPv. An international analysis of cigarette affordability. *Tob Control* 2004;**13**:339–46.
- 11 Hersch J. Gender, income levels, and the demand for cigarettes. *J Risk Uncertainty* 2000;**21**:263.
- 12 Adioetomo SM, Djutaharta T, Hendratno. Cigarette consumption, taxation, and household income: Indonesia case study Economic of Tobacco Control Paper of the World Bank 2005. (Accessed 11 December 2006).
- 13 Hu T-w, Mao Z, Liu Y, et al. Smoking, standard of living, and poverty in China. *Tob Control* 2005;**14**:247–50.
- 14 Flint AJ, Novotny TE. Poverty status and cigarette smoking prevalence and cessation in the United States, 1983–1993: the independent risk of being poor. *Tob Control* 1997;**6**:14–8.
- 15 Bobak M, Jha P, Nguyen S, et al. Poverty and smoking. In: Jha P, Chaloupka FJ, eds. *Tobacco control in developing countries*. New York: Oxford University Press, 2000.
- 16 De Beyer J, Lovelace C, Yurekli A. Poverty and tobacco. *Tob Control* 2001;**10**:210–1.
- 17 Census and Statistics Department of Hong Kong. *Gross national product (GNP) and per capita GNP*. Hong Kong: Census and Statistics Department of Hong Kong.
- 18 Census and Statistics Department of Hong Kong. *Quarterly report on general household survey (October to December 2005)*. Hong Kong: Census and Statistics Department of Hong Kong, 2006.
- 19 Union Bank of Switzerland. *Prices and earnings: a comparison of purchasing power around the globe*. Zurich: UBS, 2006.
- 20 The World Bank. *World development indicators 2006*. Washington, DC: The World Bank, 2006.
- 21 The Economist Intelligence Unit. *Worldwide cost of living*.

Take advantage of BMJ Journals' remarkable catalogue of titles with Related Collections

No busy professional has time to browse through all pertinent journals to find relevant articles, but with Related Collections you no longer have to. Follow the "Related Collections" link from any article and use the "Show Collections from other Journals" to expand your search across all BMJ Journals. Or simply follow the "Browse by topic" link on the home page. By setting up your own collections and receiving email alerts every time an article is added to your chosen area, you can build up your own significant body of knowledge.